SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-45

Name: Belle Fourche Reservoir **County:** Butte

Legal description: T 9N, R 3E Sec. 1, 2, 3, 7, 11-14, 19, 23-26, 29
Location from nearest town: 9 miles east of Belle Fourche, SD
Dates of present survey: May 21-22, 2012, July 30-August 2, 27, 2012
Date last surveyed: May 24-26, August 1-3, 19, 2011
Management classification: Warmwater permanent

Primary Species: (game and forage)	Secondary and other species:
1. Walleye	1. Yellow Perch
2. Channel Catfish	2. Smallmouth Bass
3. Gizzard Shad	3. White Bass
4. Black Crappie	4. Longnose Sucker
5.	5. Spottail Shiner
6.	6. Common Carp
7.	7. Tiger Muskellunge

PHYSICAL CHARACTERISTICS

Surface Area: 8,063 acres **Watershed**: 2,867,200 acres
Maximum depth: 55 feet **Mean depth**: 25 feet
Lake elevation at survey (from known benchmark): approximately 50% capacity

Ownership of lake and adjacent lakeshore property

The United States Bureau of Reclamation (BOR) and the Belle Fourche Irrigation District perform the operation and maintenance of Orman Dam and Belle Fourche Reservoir water levels. The South Dakota Department of Game, Fish and Parks, Division of Wildlife manages the reservoir's fish populations and 164 acres of land below the dam grade for wildlife production and the Division of Parks manages 350 acres around the boat ramp (T9N R3E, Sec. 24, 25). The BOR also manages 6,617 acres around the reservoir as wildlife habitat and for public access although irrigation has priority for water rights.

Fishing Access

Boat access is good, though crowded conditions exist as only one boat ramp is available on the largest reservoir west of the Missouri river. Shore access is generally good with public access available around the lake. Water levels do recede in summer and fall due to irrigation, and the slow tapering shoreline can become muddy and not conducive to good shore fishing. The inlet, however, does provide good shoreline access most of the year.

Observations of Water Quality and Aquatic Vegetation

Aquatic vegetation is limited to smartweed in shallow areas in the bays and inlets areas.

Observations on conditions of structures (i.e. spillway, boat ramps and docks, roads)

All structures appear to be in excellent condition. The boat ramp and fish cleaning facilities are maintained by Rocky Point State Park.

FISH POPULATION MANAGEMENT OBJECTIVES

Objective 1. To maintain a Walleye fishery with a minimum of 20 fish per gill net, a PSD range of 30-60, increase RSD-P to 10 or greater, and maintain a mean growth rate near 35.5 cm (14 in) at age-3.

Objective 2. To maintain or supplement the Gizzard Shad population through annual adult stockings of approximately 100 adults.

Objective 3. Maintain a population of Yellow Perch as another potential Walleye forage source and sportfish for anglers through adult stockings every 2 to 3 years.

Objective 4. Reintroduce Bluegill, as a potential forage source for Walleye and sportfish for anglers, by summer of 2013.

BIOLOGICAL DATA

Sampling Effort and Catch

Day-time boat electrofishing, modified fyke (trap) nets consisting of a 1.3 X 1.5 m frame, 19.1 mm (0.75 in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead and experimental gill nets (45.7 m [150 ft] long and 1.8 m [6 ft] deep with six 7.6 m [25 ft] panels of bar mesh sizes: 12.7 mm [0.5 in], 19.1 mm [0.75 in], mm [1.25 in], 38.1 mm [1.5 in], and 50.8 mm [2.0 in]), were used to accomplish fish surveys at Belle Fouche Reservoir. Eight trap nets were fished May 20-22 (Table 1) and seven gill nets were fished July 31-August 2, 2012 (Table 2). Daytime boat electrofishing was added in 2004 in attempt to increase our understanding and sample sizes concerning Gizzard Shad reproduction. Discussion on selected fish species follows and completes this report.

Table 1. Species, number capture (N), catch per unit effort (CPUE), catch per net night of stock-length fish (CPUE-S), proportional stock density (PSD) and proportional stock density of preferred size fish (PSD-P) and relative weight of stock length or greater fish (*Wr*>S) from all species collected in modified fyke trap nets in Belle Fourche Reservoir, Butte County, May 21-22, 2012. CPUE values with 80% confidence intervals in parentheses, PSD, PSD-P and *Wr*>*S values* with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	*Wr*>S
Black Bullhead	1	0.1 (0.2)	0.1 (0.2)	--	--	106.6 (--)
Black Crappie	12	1.5 (1.4)	1.5 (1.4)	92 (15)	83 (20)	98.6 (3.5)
Channel Catfish	1	0.1 (0.2)	0.1 (0.2)	--	--	84.4 (--)
River Carpsucker	3	0.4 (0.5)	0.4 (0.5)	--	--	81.9 (7.2)
Walleye	12	1.5 (0.7)	1.3 (0.6)	90 (18)	--	88.0 (7.7)
White Bass	2	0.3 (0.2)	0.3 (0.2)	--	--	80.0 (13.0)
White Crappie	30	3.8 (3.1)	3.8 (3.1)	100	100	86.0 (0.5)
Yellow Perch	4	0.5 (0.5)	0.5 (0.5)	--	--	92.2 (10.7)
Totals	65					

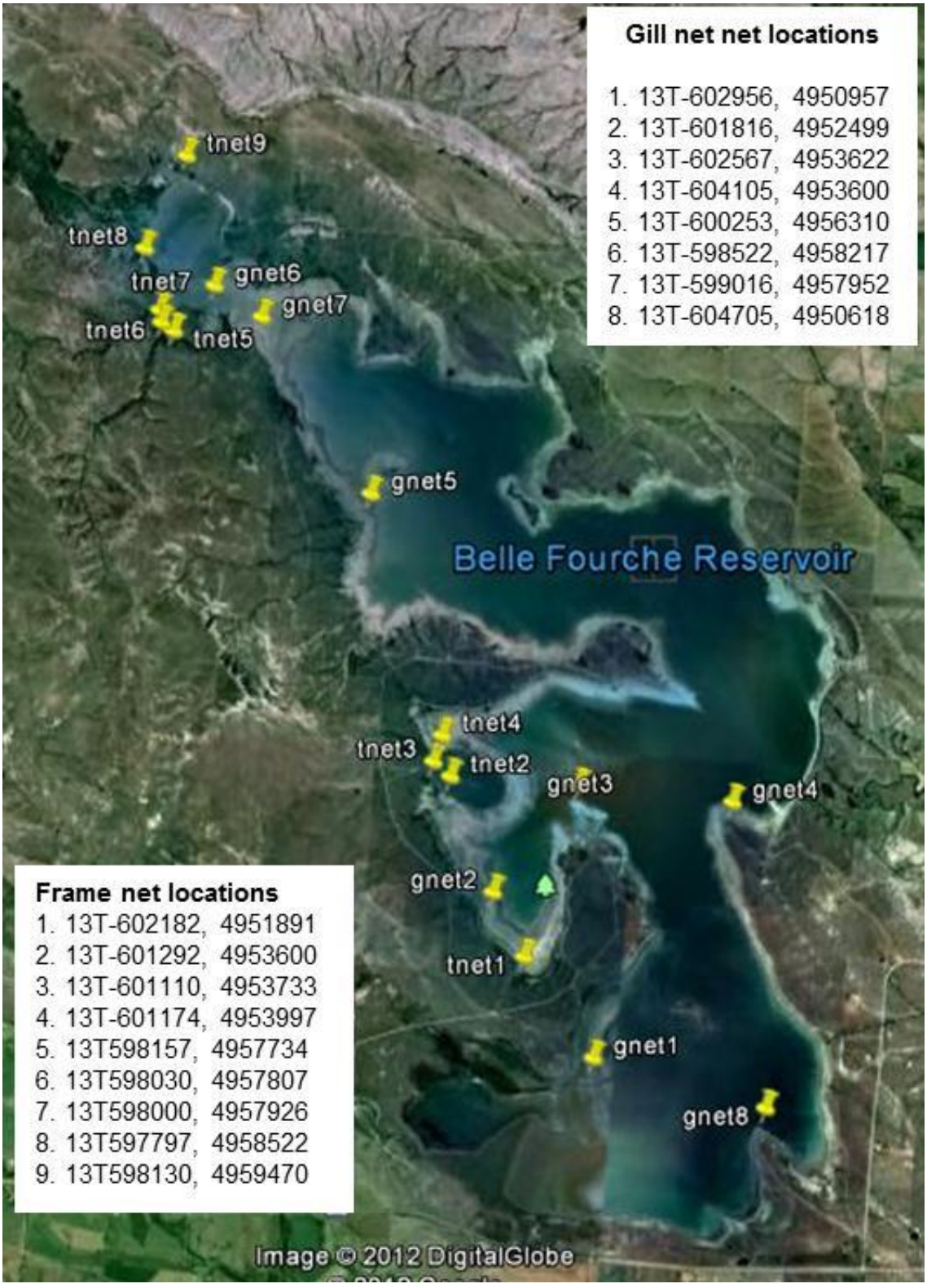

Figure 1. Locations, including GPS coordinates, of experimental gill (gill) and modified fyke (frame) nets during the fisheries survey on Belle Fourche Reservoir, Butte County, South Dakota, 2012.

Table 2. Species, number captured (N catch per unit effort (CPUE), catch per net night of stock-length fish (CPUE-S), proportional stock density (PSD) and proportional stock density of preferred size fish (PSD-P)and relative weight of stock length and greater fish (*Wr*>S) from all species collected in experimental gill nets in Belle Fourche Reservoir, Butte County, South Dakota July 31-August 2, 2012. CPUE values with 80% confidence intervals in parentheses, PSD, PSD-P and *Wr*>*S* values with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	*Wr*>S
Channel Catfish	28	4.0 (1.2)	4.0 (1.2)	96 (6)	7 (9)	86.8 (1.9)
Common Carp	8	1.1 (0.6)	1.1 (0.6)	100	13 (23)	88.3 (3.4)
Freshwater Drum	6	0.9 (0.4)	0.9 (0.4)	--	--	94.3 (11.6)
Gizzard shad	18	2.6 (1.6)	2.4 (1.4)	--	--	117.3 (2.2)
Northern Pike	3	0.4 (0.3)	0.4 (0.3)	--	--	82.5 (6.3)
River Carpsucker	3	0.4 (0.4)	0.4 (0.4)	--	--	94.1 (7.1)
Shorthead Redhorse	6	0.9 (0.5)	0.7 (0.5)	--	--	103.3 (1.5)
Smallmouth Bass	6	0.9 (0.5)	0.7 (0.5)	--	--	90.2 (6.2)
Spottail Shiner	30	4.3 (2.3)	--	--	--	--
Walleye	125	17.9 (5.0)	16.3 (4.8)	44 (8)	1 (1)	78.2 (0.2)
White Bass	16	2.3 (1.0)	2.1 (1.0)	80 (19)	80 (19)	86.1 (2.0)
White Crappie	4	0.6 (0.4)	0.4 (0.4)	--	--	88.5 (1.9)
Yellow Perch	87	12.4 (3.2)	8.6 (2.7)	55 (11)	10 (7)	93.8 (0.5)
Totals	340					

Channel Catfish

Channel Catfish catch numbers were similar to the past few years with a mean gill net catch per unit effort (CPUE) of 4.0 (Tables 3 and 4). Only one Channel Catfish was captured in the trap net sample. The length frequency histogram indicates a larger size structure with few smaller fish (Figure 2). Stock density values indicated similar findings with a proportional stock density (PSD) of 96. Fish condition was average for most years, with a mean relative weight for stock length and larger (*Wr*>S) Channel Catfish of 86.8. It appears there is one or two dominate year classes in this population with very little recruitment.

Table 4. Year, sample size (N), catch per unit effort (CPUE), catch per net night of stock-length fish (CPUE-S), proportional stock density (PSD) and proportional stock density of preferred size fish (PSD-P)and relative weight for fish larger than stock-length (*Wr*>S) for channel catfish sampled in experimental gill nets from Belle Fourche Reservoir, Butte County, South Dakota, 2009-2012. CPUE values with 80% confidence intervals in parentheses, PSD, PSD-P and *Wr*>*S* values with 90% confidence intervals.

Year	N	CPUE	PSD	PSD-P	*Wr*>S
2009	14	1.8 (0.9)	77 (22)	0	91.2 (2.7)
2010	32	4.0 (1.1)	84 (--)	6 (--)	88.2 (1.7)
2011	23	2.9 (0.9)	87 (12)	13 (12)	85.6 (2.8)
2012	28	4.0 (1.2)	96 (6)	7 (9)	86.8 (1.9)

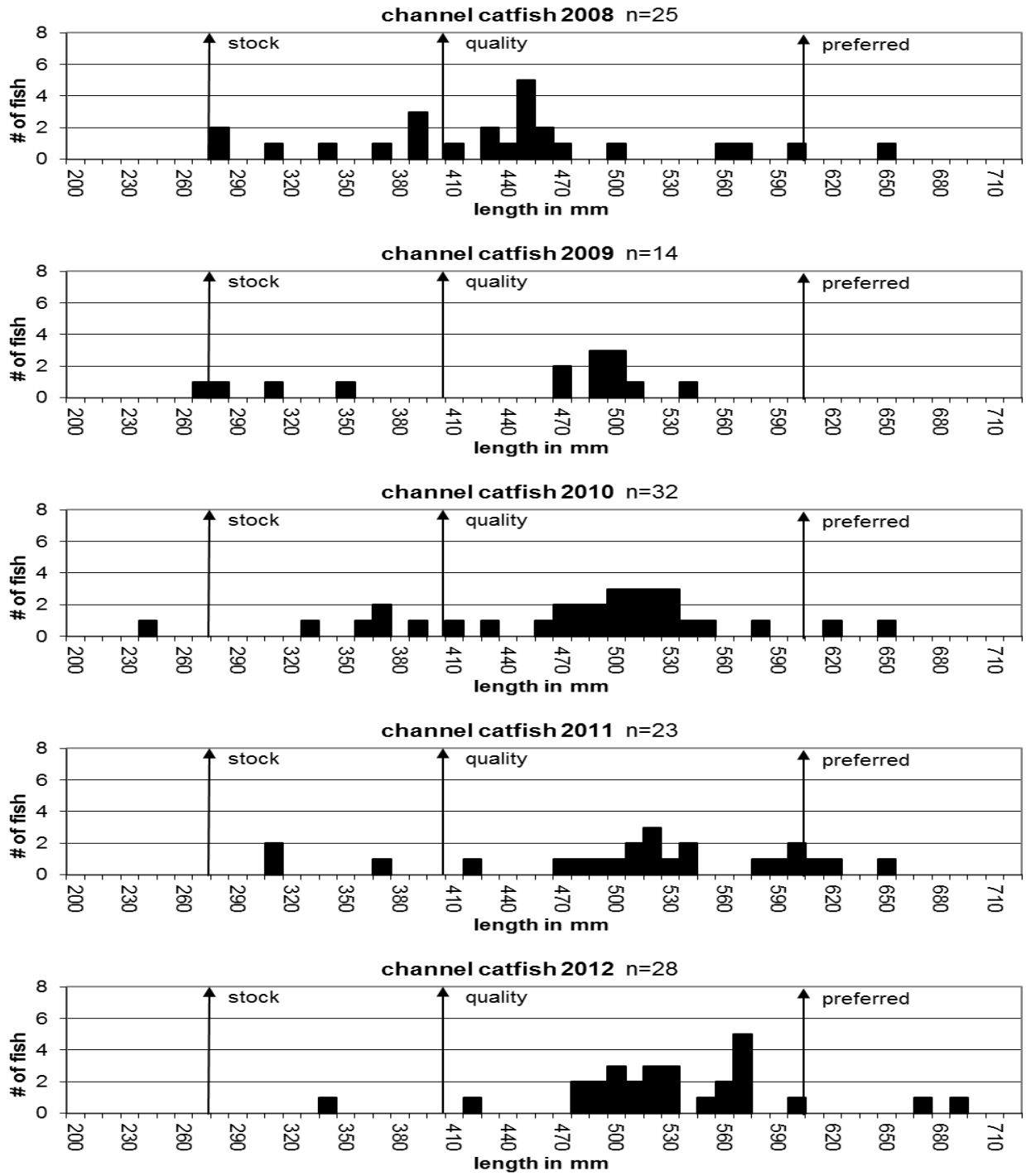

Figure 2. Length frequency histograms of Channel Catfish collected in experimental gill nets from Belle Fourche Reservoir, Butte County, South Dakota, 2008-2012.

Gizzard Shad

Gizzard Shad were re-introduced into Belle Fourche Reservoir in 1997 and adult stockings are accomplished annually to promote natural reproduction in cases where adult biomass is

reduced by winter conditions. Gizzard Shad were re-introduced in attempt to provide an additional forage fish for Walleye and improve Walleye growth rate as a previous study indicated that age-0 Gizzard Shad were the primary forage for Walleye from late July to September (Ward 2005).

In 2012, gill net catch per unit effort for stock length and larger (CPUE-S) Gizzard Shad was 2.4 (Table 2). These fish were likely age-1 and survived last year due to a mild winter. Age-0 Gizzard Shad are collected through daytime boat electrofishing and numbers have been highly variable during sampling (Table 5). Numbers have dipped sharply the past three years in the age-0 survey. Daytime boat electrofishing yielded a mean CPUE of 38.0 (Table 6). A colder than normal winter in 2009/2010 may have negatively affected over-winter survival and overall reproduction.

Table 5. Year, number captured (N), time in hours (hrs), and catch per unit effort (CPUE) for daytime electrofishing catch of age-0 Gizzard Shad from the Belle Fourche Reservoir, Butte County, South Dakota, 2005-2012.

Year	N	Time (hrs)	CPUE
2005	763	0.83	919.3
2006	3,112	0.83	3,749.4
2007	1,179	0.83	1,420.5
2008	185	1.0	185.0
2009	319	1.3	255.2
2010	41	1.7	24.1
2011	81	1.25	64.8
2012	54	1.42	38.0

Table 6. Site, number collected per site (No./Site), time in seconds (sec) and number capture per hour (No./hr) for daytime electrofishing of age-0 Gizzard Shad from Belle Fourche Reservoir, Butte County, South Dakota, August 27, 2012.

Site	No./Site	Time (sec)	No./hr
#1 Upper-1	0	600	0
#1 Upper-2	0	600	0
#1 Upper-3	0	600	0
#2 Upper-1	4	300	48
#2 Upper-2	15	600	90
Middle-1	0	600	0
Middle-2	0	600	0
Middle-3	0	600	0
Lower-1	5	300	60
Lower-2	30	300	360
Total	54	1.42hrs	38.0

Walleye

Walleye abundance appears to have increased from 2012 as gill net CPUE increased to 17.9, compared to 8.1 last year (Tables 3 and 7). Size structure has remained similar as PSD was 44, compared to 50 last year. The number of fish over twenty inches remains low with a PSD-P of 1, compared to three in 2012. The length frequency histogram and stock density values indicate a fairly balanced population with good recruitment (Figure 3).

Fish condition remains low with an average *Wr>S* of 78.2, compared to 77.1 last year. This may be a reflection of the poor Gizzard Shad reproduction observed the past two years, which likely resulted in reduced forage availability. Growth appears slow in recent years as age-3 fish averaged 331 mm (Table 8). This is probably a reflection of a strong age-4 year class combined with poor Gizzard Shad numbers the last three years.

Table 7. Year, number sampled (N), catch per unit effort (CPUE), catch per net night of stock-length fish (CPUE-S), proportional stock density (PSD) and proportional stock density of preferred size fish (PSD-P) for Walleye collected by experimental gill nets in Belle Fourche Reservoir, Butte County, South Dakota, 2006-2012. CPUE values with 80% confidence intervals in parentheses, PSD and PSD-P values with 90% confidence intervals in parentheses.

Year	N	CPUE	CPUE-S	PSD	PSD-P
2006	110	27.5 (15.7)	25.3 (14.9)	45 (9)	0
2007	114	19.0 (10.5)	14.0 (8.4)	69 (8)	0
2008	101	16.8 (6.7)	16.2 (6.1)	46 (9)	1 (2)
2009	62	7.8 (2.4)	6.1 (1.9)	71 (11)	0
2010	80	10.0 (4.0)	9.0 (3.7)	68 (9)	1 (3)
2011	65	8.1 (2.2)	8.0 (2.2)	50 (10)	3 (4)
2012	125	17.9 (5.0)	16.3 (4.8)	44 (8)	1 (1)

Table 8. Age, minimum, maximum total length at capture and weighted mean length-at-age, determined from otoliths collected from Walleye in experimental gill nets in Belle Fourche Reservoir, Butte County, South Dakota, July 31-August 2, 2012.

Age	Minimum total length	Maximum total length	Weighted mean total length at capture	Number of fish in survey
1	192	196	194	5
2	262	318	286	10
3	305	381	331	24
4	336	439	373	53
5	451	476	464	2
6	423	511	462	17
9	453	454	453	3
10	441	465	453	2
11	470	475	473	2

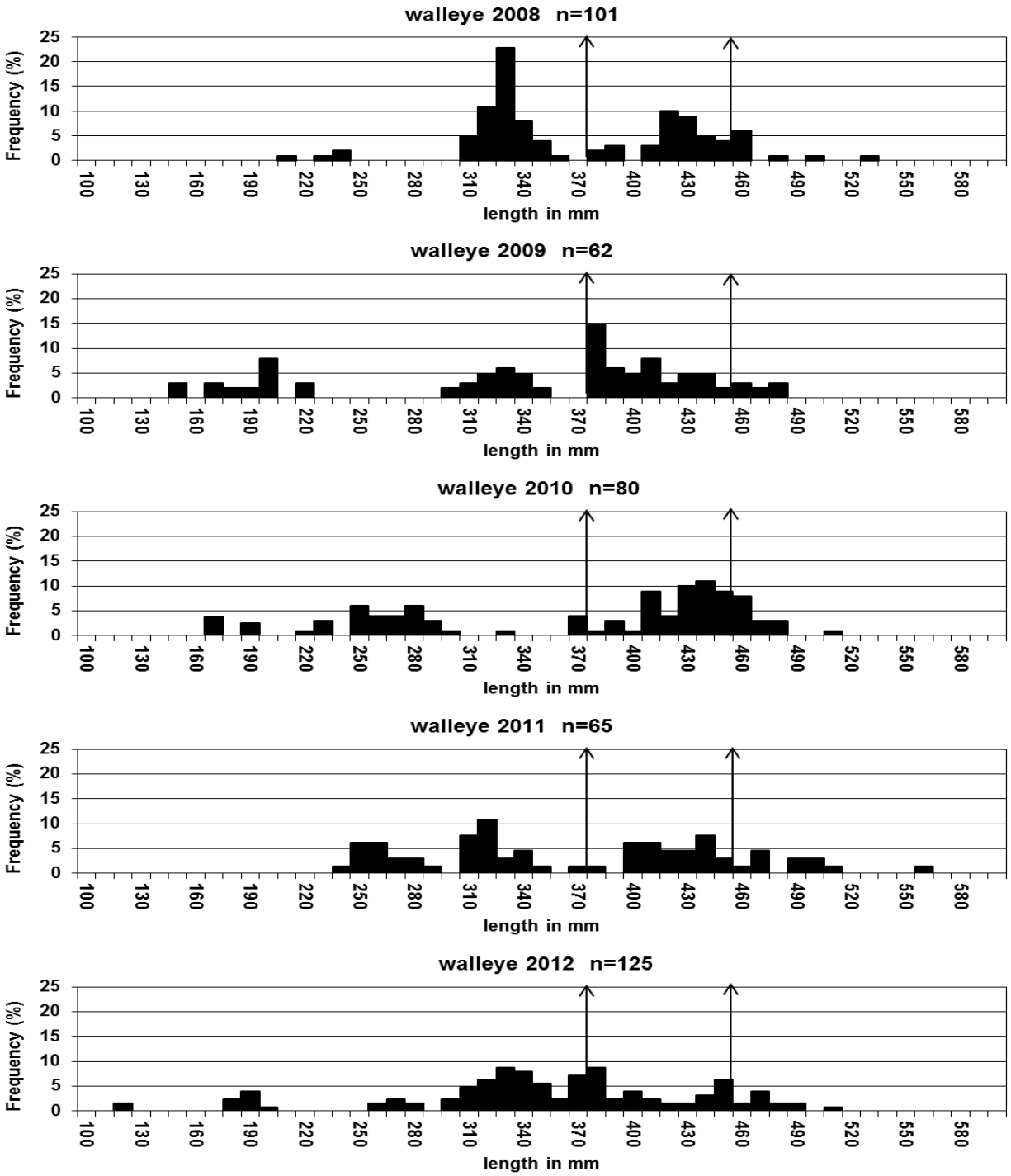

Figure 3. Length frequencies histograms for Walleye caught in experimental gill nets in Belle Fourche Reservoir, Butte County, South Dakota, 2008-2012. The arrows represent the protected slot limit (15" to 18").

Yellow Perch

Gill net CPUE were high in 2009 and 2010, dropped in 2011 and were at 12.4 in 2012 (Table 9). Stock density values show a well-balanced population with a PSD of 55 with a PSD-P of 10

(Table 3). Last year, PSD was 81 and PSD-P 9, respectively. At these sizes, Yellow Perch have become a nice bonus fish for the many anglers at Belle Fourche Reservoir. The length frequency histogram indicates steady recruitment with a consistent number of age-1 fish in the system (Figure 4).

Table 9. Year, number sampled (N), catch per unit effort (CPUE) and catch per unit effort of fish stock size and larger (CPUE-S) for Yellow Perch collected by experimental gill net in Belle Fourche Reservoir, Butte County, South Dakota, 2009-2012.

Year	N	CPUE	CPUE-S
2009	331	41.4 (13.0)	10.9 (3.8)
2010	269	33.6 (17.2)	14.9 (7.7)
2011	69	8.6 (4.2)	7.3 (3.6)
2012	87	12.4 (3.2)	8.6 (2.7)

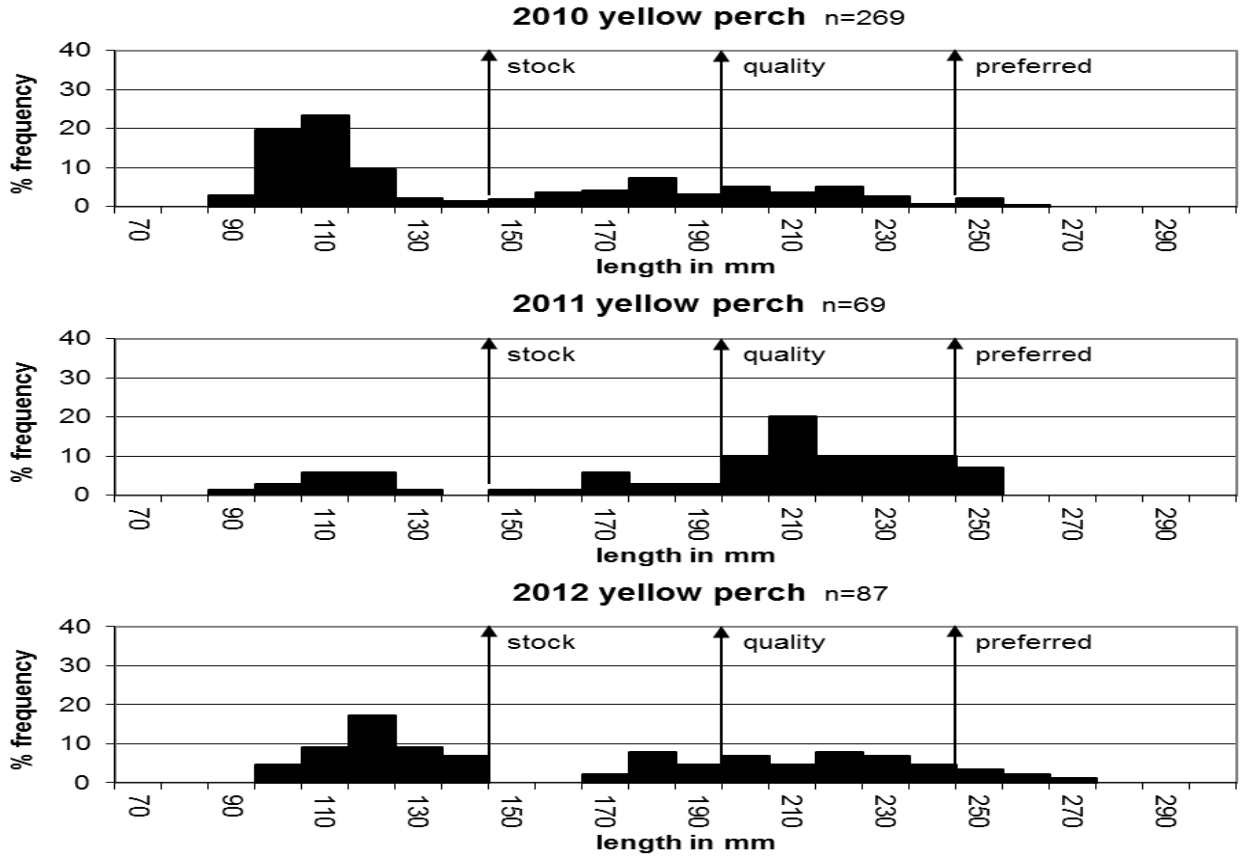

Figure 4. Length frequency histogram of Yellow Perch collected in experimental gill nets from Belle Fourche Reservoir, Butte County, South Dakota, 2010-2012.

White Crappie

White Crappie trap net CPUE was 3.8 (Table 2). Fish condition was fair with average *Wr* at 86.0 for stock-length and larger fish. White Crappie growth was excellent, with the mean age-4 fish at just 12 inches, well above the statewide mean (Table 10). The length frequency shows no recruitment in recent years (Figure 4).

Table 10. Year class, age, number captured and mean back-calculated total length (mm) at age for White Crappie collected in modified fyke nets in Belle Fouche Reservoir, Butte County, South Dakota, 2012.

Year Class	Age	N	1	2	3	4	5
2008	4	29	71	179	245	275	
2007	5	1	62	195	274	311	332
Total		30					

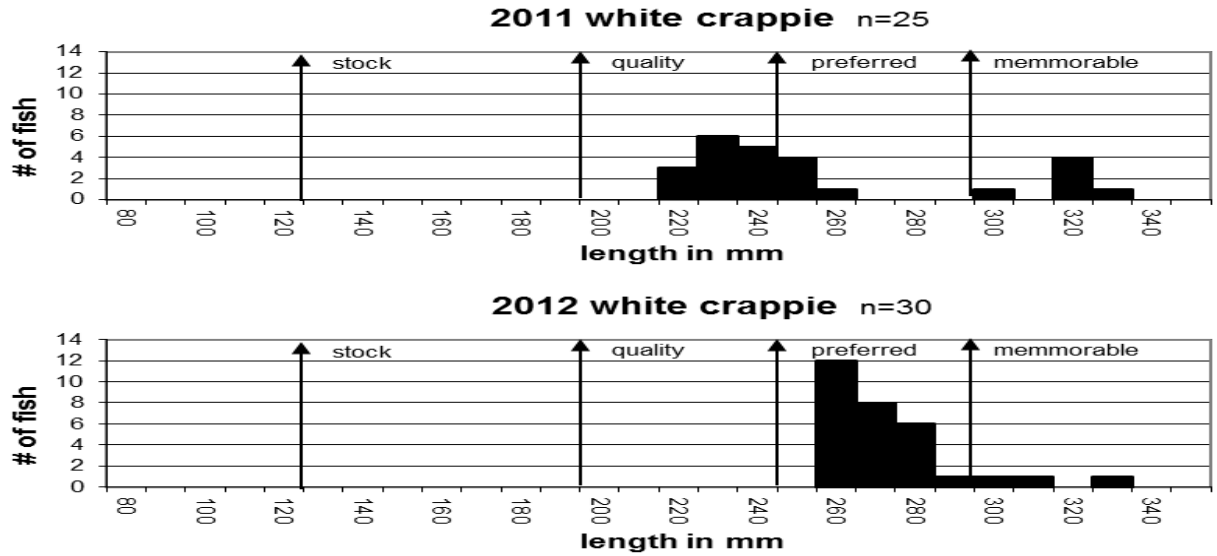

Figure 5. Length frequency histogram of White Crappie collected in modified fyke nets from Belle Fourche Reservoir, Butte County, South Dakota, 2011-2012.

RECOMMENDATIONS

1. Continue conducting lake surveys annually to evaluate fish populations and monitor regulation effects.

2. Stock adult Gizzard Shad annually to continue forage population for Walleye as over winter survival of Gizzard Shad can be poor.

3. Place Christmas tree reefs in lake to provide Yellow Perch spawning habitat and fish cover when low water exists, to enhance other forage populations when the Gizzard Shad are not available forage.

LITERATURE CITED

Ward, Matthew J. 2005. Gizzard Shad Reproductive Biology and Predator-Prey Relations with Walleyes in Western South Dakota Reservoirs. Master's Thesis. South Dakota State University. Brookings, South Dakota.

APPENDIX

Appendix A**.** Stocking history, including year, number, species and size of fish for Belle Fourche Reservoir, Butte County, South Dakota, 2003-2012.

Year	Number	Species	Size
2003	171,893	Walleye	Fingerling
	18,436	Rainbow Trout	Fingerling
	1,500	Tiger Muskellunge	Large fingerling
	102	Gizzard Shad	Adult
2004	1,605	Tiger Muskellunge	Large fingerling
	120	Gizzard Shad	Adult
2005	182	Gizzard Shad	Adult
	2,263	Splake Trout	Fingerling
2006	96	Yellow Perch	Adult
2007	52,800	Rainbow Trout	Fingerling
2008	4,600	Rainbow Trout	Fingerling
	59	Gizzard Shad	Adult
2009	74	Gizzard Shad	Adult
2010	18	Gizzard Shad	Adult
	415,406	Walleye	Fingerling
2011	175	Gizzard Shad	Adult
2012	37	Gizzard Shad	Adult
	2,507	Yellow Perch	Adult